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ABSTRACT

In the increasingly technological workforce, greater competency in mathematics, science, and computers among Latino and other minority students takes on a new urgency. Hispanic Americans are a vital pool of workers to tap for the nation's future growth. Schools must ensure that Hispanic Americans have the skills they need to enter the labor force of the 21st century. This sourcebook highlights the important role that community-based organizations, particularly those within the Latino community, have in promoting increased achievement levels in mathematics and science. It provides recommendations from experts for the implementation and design of mathematics and science community-based programs. It emphasizes the importance of creating partnerships among educators, parents, scientists, and community groups to develop programs for improving student participation in mathematics and science and increasing the number of young people in biomedical, technological, and other scientific careers. Community-based organizations play a vital role in offering and coordinating academic and non-academic informal education activities. Community-based organizations are also a natural linkage point for partnerships with institutions involved in mathematics and science, including museums, business and industry, educational institutions, and biomedical and scientific institutions. Included is an appendix that lists 20 curriculum resources and 8 hardware sources. (RLC)

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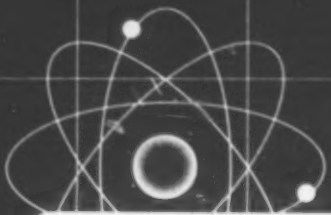
Community Based Sourcebook for promoting Mathematics & Science Education



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ASPIRA® Association, Inc.

Developed by: Hilda Crespo and Nadine Cid,
ASPIRA Association, Inc., National Office October 1991

Communities Count:

Community Based Sourcebook for promoting Mathematics & Science Education

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WHAT IS ASPIRA?

The ASPIRA Association, Inc. is a national non-profit organization which, since 1961, has served and advocated on behalf of Puerto Rican and other Latino youth. ASPIRA, the oldest Hispanic youth organization in the country, has twelve offices located in seven states, Puerto Rico, and the District of Columbia. The ASPIRA Association has long recognized the unique strengths and needs of Hispanics and other minorities through education, leadership, and research. Over the past thirty years, our effective educational programs have increased minority participation in areas where minorities have been greatly underrepresented. Annually, ASPIRA provides over 17,000 youth with the emotional, intellectual, and practical resources that they may need to remain in school and contribute to their community.

ASPIRA takes its name from the Spanish verb **aspirar**, which means "to aspire to something greater." The students that ASPIRA serves become **Aspirantes**--those who aspire to a brighter future.

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Introduction

For the past twenty years, the science and mathematics achievement levels of American middle and high school students have been falling dramatically. If we do not begin to do something now to reverse this trend, the American public will be ill prepared to understand, appreciate, or even utilize the technological and biomedical advances currently in the horizon. Clearly, it is imperative that we improve the educational attainment of all Americans.

Hispanic and other minority students are particularly at risk. According to the U.S. Census Bureau, the single most important barrier to success in the labor market for Hispanics is their low level of educational attainment. In an increasing technological society, there is greater urgency for increased competency levels in mathematics, science and computers.

This publication was developed as a sourcebook for organizations that would like to spark the imagination of young Latinos and other minority youth and encourage them to pursue excellence in mathematics and science. The sourcebook provides recommendations from a group of experts for the implementation of mathematics and science community based programs. Recommendations made here reflect a growing concensus about the unique role that community based organizations can play in supporting education. The sourcebook stresses the importance of creating partnerships among educators, parents, scientists, and community groups to develop programs aimed at improving student participation in mathematics and science, and increasing the number of young people in biomedical, technological and other scientific careers.

Most of all, the sourcebook reminds us that the Hispanic American community has a tremendous wealth of knowledge and experience which can address the educational needs of the community.

The educational lags of Hispanics need to be addressed in order to broaden the talent pool and better ensure that the nation's technological and biomedical needs are met. It is clear that positive early exposure to mathematics and science is essential in preparing Latino youth for their future. In examining the educational status of Hispanics, ASPIRA considered the following:

- The Hispanic drop-out rate is 33%--- more than twice that of African Americans (13.8%) and more than three times that of whites (12.4%). (National Center of Education Statistics, 1989)

- In 1989, Hispanics comprised 7.3% of the U.S. labor force, whereas they make up only 2.3% of the engineers, 3.0% of the computer systems analysts and scientists and 2.7% of all natural scientists (U.S. Department of Labor, 1989).

- While Hispanics comprise 9% of the population; they only hold 3% of all bachelors' degrees and 2% of all Ph.D.'s in science and engineering (Task Force on Women, Minorities, and the Handicapped in Science and Technology, December, 1989).

- Hispanic Ph.D.'s represent about 1.7% of all doctoral degree recipients in mathematics and science (National Science Foundation, 1989).

- At the precollege level, Hispanics are not enrolled in academic curricula as often as non-Hispanics, nor do they take as many years of mathematics and science coursework (National Science Foundation, 1984).

- High school completion, college access and graduation rates for Hispanics are dramatically lower than for whites. ASPIRA studies indicate that in metropolitan areas, Puerto Rican and other Latino youth drop out at rates that vary from 50% to 80%.

- U.S. Census data show that Hispanic students use computers less frequently than non-Hispanics. One-third of Hispanic children aged 3-17 used a computer in 1989 compared with about 1/2 of non-Hispanics. Ten percent of Hispanic children lived in homes with a computer (U.S. Bureau of the Census, 1990).

- The National Assessment of Educational Progress showed that only 47% of eighth-grade Hispanics compared with 77% of white students could do simple multiplicative reasoning and beginning two-step problems (U.S. Department of Education, 1991).

- In 1990, Hispanic American students constituted only 5.6% of all applicants to U.S. medical schools (Association of American Medical Colleges, 1991).

- The U.S. Census data (1990) indicate that although Hispanics represent 9.2% of the population and 7.5% of the labor force, they comprise only 4.5% of physicians, 3.5% of dentists and 2.5% of registered nurses.

- 60% of the 2.4 million youth who graduated from high school in 1990 were enrolled in college in October, a proportion equaling the record set the previous year (U.S. Department of Labor's Bureau of Labor Statistics).

- About 1.4 million members of the high school class of 1990 were attending college in October, most of them full-time. The college enrollment rate of women (62%) exceeded that for men (58%), and the rate for whites (62%) remained well above that of blacks (46%) and Hispanics (47%) (U.S. Department of Labor's Bureau of Labor Statistics).

What Do Experts Say?

In January, 1990, ASPIRA brought together a group of 27 experts involved in mathematics education, science education, and intervention programs. Also attending the roundtable meeting were executive staff from the ASPIRA Association. The catalyst for the meeting was ASPIRA's concern for opening educational opportunities to increase Hispanic participation in mathematics and science. The group discussed strategies for raising expectations and achievement levels of Latino students. It also provided a framework for discussing the full range of activities required to develop effective community based programs for working with Latino students. Participants were selected from initial recommendations and other sources in ASPIRA's network. Efforts were made to include participants with different perspectives, and from each region of the country.

Participant recommendations focused on a variety of interrelated issues related to the important role community based organization should play in promoting mathematics and science education:

- considerations for program design
- appropriate academic and skills building activities
- essential non-academic activities
- parental involvement
- effective collaborations with schools, other institutions, and independent organizations
- potential resources

" There's definitely a role for community based organizations with students who aren't traditionally perceived as going to make it..."

DeAnna Beane, Education Consultant

Program Design

In designing a community based program in mathematics and science, community based organizations can draw on many of their strengths. These include their flexibility in offering programs, their ability to work with various age levels, their ability to work collaboratively with various institutions and their linkages with parents, schools, universities and community groups. These suggestions should be considered in designing an effective program.

- ▲ Target participants no later than junior high school, ideally seventh and eighth grade
- ▲ Map out a blueprint that starts at the pre-K level and follows the student through the education ladder
- ▲ Schedule program activities that include an after school program, a Saturday enrichment program and/or a summer program
- ▲ Examine existing models for program curiculum and identify those that have proven effective for use with the target population. There is no need to replicate existing efforts.
- ▲ Select curriculum models that are culturally sensitive and appropriate for the age group
- ▲ Provide after-school academic support activities without replicating what is going on in the classroom
- ▲ Include a parental awareness component to link parents with the educational system

- Collect and maintain program data to monitor student progress and the impact of the program on participants
- Offer long-term and sustained contact with students
- Sponsor intervention programs aimed at Hispanic youth to greater ensure that they receive quality education
- Sponsor programs for Hispanic youth in mathematics and science education, particularly for at risk students who are not traditionally perceived as "going to make it"
- Develop an adequate funding base for staff support, equipment, computers and other material resources to allow for an effective intervention prgram
- Work with a team of teachers from the target schools
- Provide staff training to upgrade skills of teachers, counselors and volunteers

"We have found our most successful programs are starting no later than junior high"

Orlando Gutierrez, NASA

Activities

ACADEMIC AND NON-ACADEMIC

There is a real need for community based organizations to play a role in enhancing the self-esteem of students, fostering positive attitudes towards mathematics and science, and providing exposure to role models. Community based organizations play an important role in providing informal skills building activities, in mathematics, science, English and general life skills. Experts concur that non-cognitive skills and non-academic activities are as important as the academic and skills building activities. Students need to develop motivational as well as intellectual skills. The following suggestions address academic and non-academic activities for stimulating students' interests and performance in mathematics and science:

- Help students develop critical thinking and reasoning skills to enhance creative problem solving
- Provide mathematics and science instruction and tutorials to supplement classroom instructions
- Encourage cooperative learning through projects that provide hands-on activities and allow students to take intellectual risks
- Provide students with early exposure to algebra and geometry
- Incorporate exposure to computer technology to enhance students' proficiency in their use

- Assist students in developing effective study skills
- Upgrade language skills while increasing cognitive skills in mathematics and science
- Offer students personal and career counseling sessions
- Provide short-term immediate rewards to motivate students and increase self-esteem
- Address the social needs of students within the context of mathematics and science education
- Develop coping skills of students to enhance their academic achievement
- Encourage students to set short and long term goals
- Cultivate students' ability to deal with negative peer pressure
- Introduce career role models and mentors to students particularly in biomedical, technological and scientific areas
- Monitor homework assignments on a regular basis
- Provide trips to museums, space centers, industrial sites and biomedical and scientific institutions, colleges and universities and health professional schools
- Provide opportunities for students to realize how mathematics and science are part of eveyday life

"Try to provide teachers with enrichment materials and think of innovative ways to make` science and math interesting for the student..."

Billie Hicks, SCEME

Parental Involvement

The ability of community based organizations to relate to parents is a recognized strength. In the cases where there is a population of Hispanics with limited English proficiency, community based organizations can (and often) intercede on behalf of the parents. Community based organizations can operate as extended families for those children whose parents may need assistance or be absent. Likewise, parents need to be active partners in their children's education and also need to learn the fundamentals of understanding and working with the educational system. Parents and community-based organizations should:

- Ask children about their school work on a daily basis
- Communicate their expectations of teachers
- Help the student develop good study habits
- Encourage students to provide workshops for parents to assist them in supporting their child's interest and achievement in mathematics and science.
- Know the expectations of teachers
- Schedule frequent meetings with teachers to keep abreast of child's progress
- Try to obtain extra copies of child's materials to become familiar with curriculum
- Understand the importance of keeping the child in school and not sacrifice the child's education to fulfill family responsibilities during school time

- Set high expectations for the child's academic performances and demand that the school provide quality education
- Take the child to zoos, museums, libraries, hospitals, and scientific institutions
- Enroll the child in reading, science, mathematics, and career clubs
- Enroll child in summer mathematics and science programs
- Encourage the use of the English and Spanish languages at home

"The parents need to know what the teachers are doing. The teachers need to know what the parents expectations are..."

Fred Stein, Prisms

Community Based Partnerships

Partnerships amoung schools, businesses, scientific institutions and coummunity-based organizations are essential for developing the future talent of America's youth. This collaborative approach strengthens the efforts to increase student achievement levels in mathematics and science and ensures sharing of resources and responsibilities. Partners in the collaboration can exercise the following roles:

- Facilitate student access to computers, scientific equipment, updated textbooks, and other enrichment materials that make science and mathematics interesting
- Facilitate teacher training courses that are free of cultural and gender biases
- Assist in procuring funding to support education intervention effort
- Support programs that upgrade teaching skills of instructors
- Support what is offered by the educational system through mentoring, tutoring, and field trips
- Encourage other institutions, such as, museums, businesses, science centers, biomedical centers, local industry and Federal laboratories to take an active part in collaborative efforts.

"Form linkages with the museum and science centers in those communities and demand that they be outreach programs"

DeAnna Beane, Education Consultant

Summary

In our increasingly technological workforce, greater competency in mathematics, science and computers among Latino and other minority students takes on a new urgency. It is recognized that Hispanics will be a vital pool of workers to tap for the nation's future growth. Thus, it is in our nation's interest to ensure they have the skills they need to enter the labor force of the 21st century.

This sourcebook clearly points to the important role that community based organizations, particularly those within the Latino community, have in promoting increased achievement levels in mathematics and science. The strengths of these organizations in working within communities, and in doing outreach with parents is well understood. What is often overlooked is that community based organizations play a vital role in offering and coordinating academic and nonacademic informal education activities. Community based organizations are also a natural linkage-point for partnerships with institutions involved in mathematics and science, including; museums, business and industry, educational institutions, and biomedical and scientific institutions.

Ultimately, preparing tomorrow's workforce will require aggressive commitments and comprehensive strategies from all sectors including community based organizations. Meeting the challenges of a new century will require effective partnerships and collaborations.

Appendix

FINANCIAL SUPPORT
Sources identified for supporting the program include individuals, foundations, corporations, state and Federal agencies, professional associations, businesses and industry.

CURRICULUM RESOURCES
Several curriculum models were identified for offering informal science and mathematics education. These include the following:

Action Kit developed by: Children's Television Workshop (CTW), 1 Lincoln Plaza, New York, NY 10023

ALGEBRIDGE developed by: Educational Testing Services, Princeton, NJ and The College Board, New York, NY

CRITICAL THINKING and SCIENCE SKILLS developed by: Educational Testing Service, Princeton, NJ

FAMILY MATH developed by: EQUALS Program, Lawrence Hall of Science, University of California, Berkeley, CA 94720

FAMILY SCIENCE developed by: Lawrence Hall of Science, University of California, Berkeley, CA 94720

The Growing Classroom developed by: Life Lab Science Program, 1156 High Street, Santa Cruz, CA 95064

Hands On Science developed by: Hands On Science Outreach, Inc. , 4910 Macon Road, Rockville, MD 20852

Integrated Science Math and Technology developed by: Math Sciences Nucleus, 3710 Yale Way, Fremont, CA 94538

NatureScope developed by: National Wildlife Federation (NWF) , 1400 16th Street, N.W. Washington, D.C. 20035

PROJECT AIMS developed by: AIMS Education Foundation, P.O. Box 8120, Fresno, CA 93747

Science Resources For Schools developed by: American Association for the Advancement of Science, Directorate for Education and Human Resources Programs, 1333 H Street, N.W. , Washington, D.C. 20005

Sourcebook of Biotechnology Activities developed by: National Association of Biology Teachers, 11250 Roger Bacon Drive, #19, Reston, VA 22090 and North Carolina Biotechnology Center, Research Triangle Park, NC

Super Kit developed by: Children's Television Workshop (CTW), 1 Lincoln Plaza, New York, NY 10023

The Class Project developed by: National Wildlife Federation (NWF), 1400 16th Street, N.W. Washington, D.C. 20035

Tour of the Solar System (includes slides) developed by: Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058

Wonder Science developed by: The American Chemical Society, 1155 16th Street, N.W. , Washington D.C. 20036, and the American Institute of Physics, 1852 Connecticut Avenue, N.W. , Suite 213, Washington, D.C. 20009

Materials also available through:

National Association for Science, Technology, and Society (NASTS), 117 Willard Building, Pennsylvania State University, University Park, PA 16802

National Science Resource Center, Arts and Industries Building, Room 1201, Smithsonian Institution, Washington, D.C. 20560

United States Space Foundation, P.O. Box 1838, Colorado Springs, CO 80901

University of Chicago School Mathematics Project, 5835 South Kimbark, Chicago, IL 60637

POTENTIAL HARDWARE SOURCES

Potential sources for computers and other hardware include the following:

International Business Machines (IBM), 2000 Purchase Street Purchase, NY 10577

Digital Equipment Corporation (DEC), 111 Powder Mill Road, Maynard, MA 01754-1418

Tandy Corporation, 1800 One Tandy Center, Fort Worth, TX 76102

Apple Computers, Inc. , 608 Second Avenue South, Minneapolis, MN 55402

GTE Corporation, One Stamford Forum, Stamford, CT 06904

Westinghouse Foundation, Westinghouse Building, Gateway Center, Pittsburgh, PA 15222

Hewlett-Packard Company, 3000 Hanover Street, Palo Alto, CA 94304

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